

SATURDAY, AUGUST 21, 1880.

ETHNOLOGY.*

FRAGMENTARY NOTES ON THE ESKIMO OF CUMBERLAND SOUND.

BY LUDWIG KUMLIEN.

The record of the voyage of the *Florence*, the vessel which conveyed the Howgate preliminary Polar expedition, has been printed by the Smithsonian Institution by request of Professor Spencer F. Baird, and forms the fifteenth of a series of papers intended to illustrate the collection of natural history and ethnology belonging to the United States, constituting the National Museum, placed in charge of the Smithsonian Institution by an act of Congress.

The report on "Ethnology" by Ludwig Kumlien is of great interest, and on this occasion we confine our attention to this part of the work, reserving other branches for future notice.

He states that the Cumberland Straits, Sound, Gulf or Inlet, extends from about lat. 65° N. to lat. $67^{\circ} +$ N. It is the Cumberland Straits of Baffin, its original discoverer at the end of the sixteenth century; the Hogarth Sound of Captain Penny, who re-discovered it in 1839; and the Northumberland Inlet of Captain Wareham in 1841.

During the last quarter century it has often been visited by Scotch and American whalers, ships frequently wintering on the southwestern shores.

It is at present unknown whether it be a sound or gulf; it is generally considered to be a gulf, but some Eskimo say that the Kingwah Fjord, one of the arms extending to the NE., opens into a large expanse of water, to them unknown. Icebergs are also sometimes found in this fjord which from their positions, seem to have come from the northward, and not from the south.

The eastern shore of this sound forms the western boundary of that portion of Cumberland Island which lies between its waters and Davis Straits, and known as the Penny Peninsula.

In about lat. 66° N. the Kingnite Fjord extends from the sound in a ENE. direction, and nearly joins Exeter Sound from Davis Straits; they are separated only by a portage of a few miles. The Cumberland Eskimo make frequent excursions to the eastern shore *via* these fjords, but seem to have extended their migrations but a short distance northward, finding Cumberland Sound more to their tastes.

The width of Cumberland Sound opposite Niantilic is about thirty miles, possibly its widest part. It is indented by numerous and large fjords, few, if any, of them having been explored; many islands are scattered along both shores, and in some instances form quite considerable groups.

The present Eskimo are few in numbers. We would estimate the entire population, men, women,

and children, on both sides of the sound, from Cape Mercy on the east to Nugumeute on the west, not to exceed four hundred individuals. It is certain that within the last thirty years the mortality has been very great among them; even the whalers remark an astonishing diminution in their numbers at the present day, as compared with twenty years ago.

Numerous traditions exist among them of the time when they warred with other tribes, and old men, now living, have pointed out to us islands that were once the scene of battles, where the besieged party was starved into submission by their enemies. According to the usual story, the hurling of stones was one of the most effective and common modes of warfare; this was especially the case when one party could get upon a ledge above the other. At the present day they are peaceful and quiet, have no recognized leader, and no desire to fight, even if their numbers would permit of it.

As the story goes, the present population were the victors in those fights, and took possession of the country they now inhabit. Some say they came from the northwest, and found another tribe, which they overcame and drove away. Their stories on this subject vary, and sometimes with this unusually interesting tradition, as well as many others, they get events of a very recent date hopelessly mixed up with the rest; and it is no unusual instance to find that some whaler, with a good imagination, has supplied and restored lost portions of the narrative, to their entire satisfaction; but these restorations are chiefly remarkable for their utter disregard of truth or possibility.

The following tradition is a translation from one of the most reliable natives we became acquainted with:

"A long time ago (*tichemaniadlo*) other Innuits (Eskimo) were found here; they were called 'Tunak'; they were very strong, very large, and had short legs and large arms; they had very wide chests. Their clothes were made of bear skins, and their knives from walrus tusks. They did not use bows and arrows, but only the harpoon-lance; they harpooned the reindeer in the water, from their kyacks, which were very large. The *Tunuks* made houses out of stone. They were able to lift large stones. We were afraid of them; we fought with them and killed them. They (the *Tunuks*) came in the first place from *Greenland*. The women made clothes from their own hair. They had no dogs at that time, but they made sledges and harnesses, and finally (*witchou* = by and by) put the harnesses on three rocks, one white, one red, and one black; they then called, and when they looked they found the stones had been transformed into dogs. After a time they got plenty of dogs; then they went about more. The present Eskimo could not understand their language. They lived to a great age (*E. tukewouk nami* = did not die!). Far to the west some Eskimo lately saw some *Tunuks*; they had bear-skin clothing. In the *Tunuks* land (where?) the *musk ox* (*oming muk*), bear, and seals are abundant. They build walls of stones on the land, and drive the reindeer into ponds, and catch them in kyacks. They have a large, long *callytong* (coat, or jumper jacket) that they fasten down around them on the ice while they are watching a seal's hole; underneath this garment, on the ice, they place a lamp; over this lamp they cook meat. Their eyes

* Bulletin (15) of the U. S. National Museum. Contributed to the Natural History of Arctic America made in connection with the Howgate Polar expedition 1877-78. Washington: Government Printing Office. 1879.

are sore all the time. We are afraid of them; do not like them; glad they have gone away."

This tradition differs somewhat in the particulars when told by different individuals, but the main points are essentially the same. Many will not tell it all; some, only parts of it. The ridiculous story about the dogs is firmly believed by the present Eskimo as the origin of these animals.

That the *Tunuk* have been seen of late years in the west is not improbable—that is, natives, different in dress and stature; but they were most likely the tribe known as the Pelly Bay Eskimo from the north shores of Hudson's Straits and from Fox Channel, they being larger and more robust than the Cumberland Eskimo of the present day. It is certain that since the whalers have begun coming among the Cumberland Eskimo, and introduced venereal diseases, they have deteriorated very much. They now almost depend upon ships coming, and as a consequence are becoming less expert hunters, and more careless in the construction of their habitations, which are merely rude temporary shelters made at a few minutes' notice. Great suffering often ensues from living in these miserable huts. The seal skin that should have gone to repair the tent is bartered to the whalers for a little tobacco, or some valueless trinket, which is soon thrown aside. The men are employed to catch whales, when they should be hunting in order to supply the wants of their families; and the women, half clad, but sporting a gaudy calico gown, instead of their comfortable skin clothes, and dying of a quick consumption in consequence, when they should be repairing garments or preparing skins, are loafing around the ships, doing nothing for themselves or any one else.

The Cumberland Eskimo of to day, with his breech-loading rifle, steel knives, cotton jacket, and all the various trinkets he succeeds in procuring from the ships, is worse clad, lives poorer, and gets less to eat than did his forefathers, who had never seen or heard of a white man.

There is a practice among them that is probably of long standing, and is regularly carried out every season, of going into the interior or up some of the large fjords after reindeer. They generally go during the months of July and August, returning in September, to be on hand when the fall whaling begins. The purpose of this reindeer hunt is to procure skins for their winter clothing. Nearly all return to the sound to winter. They have regular settlements, which are hardly ever entirely deserted at any season. The principal ones are known as Nugumeute, Niantilie, Newboyant, Kemesuit, Annanactook, Oosoadluin, Ejujuajuin, Kikkerton. and Middlejuacktuack Islands, and Shaumeer, situate at different points on both sides of Cumberland Sound. During the winter they congregate at these points in little villages of snow-huts.

The present principal headquarters are at the Kikkerton Islands, or at Niantilie, according to which point the whalers winter. The old harbor of Kemasuit, once the winter harbor of whalers and a favorite resort of the Eskimo, is now deserted, except by a few superannuated couples, who manage to catch enough seal to live on.

As a rule, the present race is of short stature, the men from five feet three inches to five feet six. There are some exceptions, but they are in favor of a less rather than a greater height. The women are a little shorter. The lower extremities are rather short in proportion to the body, and bow-legs are almost the rule. This probably arises from the manner in which the children are carried in the mother's hood, as well as the early age at which they attempt to walk. The habit of sitting cross-legs may also have a tendency to produce this deformity. Their hands and feet are small and well formed. Their hands are almost covered with the scars of cuts and bruises. It seems that in healing the injured part rises, and is always afterwards disgustingly prominent. There is a great variation in the color of their skin, and a description that would answer for one might not apply at all to another. Even among those that are of pure breed there are some whose skins are no darker than a white man's would be if subjected to the rigors of wind and cold, and the never-removed accumulation of soot and grease. Others again seem to have been "born so." The children, when young, are quite fair. The eyes are small, oblique, and black or very dark brown. The hair is black, straight, coarse, and very abundant. It is rarely wavy or curly among the full-blooded Innuites.

There are, of course, exceptions to the above in case of half-breeds. Their faces are broad and flat, with rather large lips and prominent cheek-bones.

Infanticide is not practiced among the Cumberland Eskimo at the present day. I have learned from some of the most intelligent that this barbarous custom was in vogue in former times, however. Among the natives of Repulse Bay, and those living on the north shores of Hudson's Straits, it is practiced to a considerable extent, especially with the tribe known as the Pelly Bay natives. The practice is confined almost entirely to female children, the reason being, they tell us, that they are unable to hunt, and consequently of little account. It seems to have been referable to the same cause among the Cumberland Eskimo. Their intercourse with the whites seems to have modified some of the most barbarous of their primitive habits.

Twins are not common, and triplets very rare. The males outnumber the females. Infanticide may, to some extent, be the cause; but lung diseases, which are alarmingly prevalent, seem more fatal to the women than to the men.

Children are often mated by the parents while they are still mere infants. There is such an extreme laxity of morals that the young women almost invariably become wives only a short time before they are mothers.

It is impossible to say at what age the women cease to bear children, as they have no idea of their own age, and few are able to count above ten. Puberty takes place at an early age, possibly at fourteen with the female. They are not a prolific race, and it is seldom a woman has more than two or three children, and often only one, of her own; still many, or almost all, have children; but inquiry will generally divulge the fact that some of the children have been bought. Almost every young woman has or has had a child, but the identity of the father is in no wise necessary in

order to insure the respectability of the mother or child. Such children are generally traded or given away to some elderly couple as soon as they are old enough to leave the mother. The foster-parents take quite as good care of such adopted children as if they were their own.

So far as we could learn, they do not generally practice any rites or ceremonies of marriage. The best hunter, or the owner of the largest number of dogs and hunting-gear, will seldom have any difficulty in procuring the woman of his choice for a wife, even though she has a husband at the time. It is a common practice to trade wives for short periods or even permanently. They appear to have marriage rites sometimes, but we could induce no one to tell us, except one squaw, who agreed to, but only on condition that we became one of the interested parties and she the other. This was more than we had bargained for, and, although generally willing to be a martyr for the cause of science, we allowed this opportunity to pass without improving it.

Monogamy is at the present time the most prevalent. Polygamy is practiced only in the case of a man being able to provide for two or more wives. Three, and even four wives rarely belong to one man. Neither two nor three wives in one hut make an altogether harmonious household; but all little difficulties are generally settled by the husband, in a manner better calculated to insure reverence to masculine strength than respect for superior intelligence.

The scarcity of women at present in proportion to the men makes polygamy a luxury only to be indulged in by the wealthy. Divorce, if it can be called by that name, is very frequent among them. All that is needed is that the husband tires of his wife, or knows of a better one that he is able to procure. Neither does it seem to trouble the woman much; she is quite sure to have another offer before long; and a change of this kind seems to benefit both parties. One rather remarkable and very laudable practice among these people is the adoption of young children whose parents are dead, or, as often happens, whose mother is the only recognized parent. Orphans, so to speak, are thus twice as common as among civilized nations. These children, whether bought or received as a gift, are always taken as good care of as if they were their own, especially if they are boys.

Among the Eskimo employed by the Florence was a family that had two children, who passed for brother and sister. One, the boy, was a nephew of "Eskimo Joe," of Polaris fame. He had been brought from the Hudson's Straits Eskimo, some two hundred miles to the south. He was a perfect little satan; and, though he gave us much annoyance, he was a never-failing source of amusement to us all. The girl, again, was a native of Exeter Sound, on the west coast of Davis Straits; still, both were considered as their own children, and well cared for.

Half-breeds are said to be of more irritable temperaments, and less able to bear exposure and fatigue, than the full-blooded Eskimo.

The food of the Cumberland Eskimo consists entirely of flesh, and in most sections of the sound, *Pagomys fatidus*. In fact, this animal is their principal dependence for food, fuel, clothing, and light. The Eskimo will eat a few of the berries of *Vaccinium*

uliginosum and *Empetrum nigrum*, the roots of *Pedicularis*, and occasionally a little *Fucus vesiculosus* in winter, but this constitutes a very small and unimportant part of their food.

As soon as the ice has fairly left the sound, the Eskimo hunter leaves the winter encampment, with his family and such portions of his household goods as will be needed, and takes a tour inland or up some of the large fjords after reindeer. The larger part of his possessions, including sledge, dogs, harnesses, winter clothing, etc., he secretes among the rocks in some unfrequented spot. His dogs are put on some little rocky islet, to shift for themselves. They eke out a scanty subsistence by making good use of their time at low tide, *Cottus scorpius* constituting the greater part of their food at this season.

There are at present so many whaleboats owned by these Eskimo, that they experience little difficulty in making quite extensive cruises, three or four families constituting a boat's crew. They will load a whaleboat to within an inch or two of the gunwale, and then set out for a few weeks of enjoyment and abundance. The squaws do the rowing and the "captain" stands majestically in the stern with the steering oar, while the rest of the men are either asleep or on the lookout for game. The cargo consists of their tent-poles, the skin-tents, pots, and lamps, with sundry skin-bags containing the women's sewing and skinning utensils. Their hunting-gear, of course, forms a quite conspicuous portion of the contents of the boat. Very few there are at present who have not become the possessors of a half-barrel, and this vessel occupies a conspicuous place in the boat, and is almost constantly receiving additions of animal matter in some shape; a few young eiders or gulls will soon be covered up with the intestines of a seal and its flesh. From this receptacle all obtain a piece of meat whenever they feel hungry. This vessel is never emptied of its contents, except by accident or when scarcity of material forbids its repletion; and, as the temperature at this season is well up in the "sixties" during the day, this garbage heap becomes so offensive as to be unbearable to any one but an Eskimo.

They proceed at a very leisurely rate, rowing for a few minutes and then stopping for a time, chatting, smoking, or eating. When they feel tired they haul up on the rocks and have a sleep, and then resume the journey in the same vagabond manner. If, while thus cruising, any live creature that they think there is any possibility they can capture comes in sight, all hands become animated, the oars are plied with redoubled energy, guns and spears are in readiness, and every one is eager for the sport. Hours are often consumed in chasing a half-grown duck or a young loon which when procured is but a bite; but the fun of the chase seems to be the principal object, and they enjoy it hugely. Thus they journey till they reach some suitable locality, when the boat is unloaded, the toopiks raised, the lamps put in their places, and all is ready for a grand hunt. The men divide and scatter over the mountains, leaving the camp in charge of the women and children; these busy themselves by hunting for and destroying every living creature that they can find.

On the return of the hunters, who perchance have brought some skins and a hunk of venison, there are

joyous times in camp; the meat is disposed of first and then the younger people engage in various games while the older ones gather around some aged crone, who excitedly recounts the hunts of her girlhood days, plentifully intermixing stray portions of the old sagas and legends with which her memory is replete. Thus they live from day to day, the men hunting and the women stretching the skins, till the season comes around when they must return to the coast. Happy, contented, vagabond race! no thought of the morrow disturbs the tranquility of their minds.

When a deer is killed any distance from camp, the meat is cached, with the intention of returning after it in winter; but with what the wolves and foxes devour and what the Eskimo never can find again, very little is brought back.

Many have now firearms of some pattern or other; and though they will hunt for a ball that has missed its mark for half a day, they do not hesitate to fire at any useless creature that comes in their way. Those that have no guns use bows and arrows made from reindeer antlers. Sometimes the deer are driven into ponds, and even into the salt water, and captured in kyacks with harpoons.

(Continued.)

COAL.

By P. W. SHEAFER, M. E., POTTSVILLE, PA.

I.

Coal is monarch of the modern industrial world, with its wonderfully diversified interests, and their ever expanding development. But supreme as is this more than kingly power at the present time, comparatively brief as has been the period of its supremacy, and unlimited, in the popular apprehension, as are its apparent resources, yet already can we calculate its approximate duration and predict the end of its all-powerful but beneficent reign. This is especially the case with our limited Anthracite; the more widely diffused bituminous having in reserve a much longer term of service—short indeed as a segment of the world's history, but so long, compared with an average human life, as to be of slight practical concern to the present generation.

The territory occupied by the anthracite coal fields of Pennsylvania is but a diminutive spot compared with the area of bituminous coal in Pennsylvania alone, to say nothing of its vast extent in other portions of the United States, and in Great Britain, France and Belgium. The area of the anthracite of the United States is but 470 square miles, not one-twentieth the size of Lake Erie, while the wide-spread bituminous coal fields cover twice the area of our four great lakes: the anthracite making but an insignificant showing on the map of the continent. But the comparison with the bituminous area is deceptive, unless the relative thickness of the two is taken into

consideration. If the anthracite beds were spread out as thinly as those of the bituminous region they would cover eight times their present area, or 3,780 square miles. And, again, if the denuded spaces within the borders of the anthracite coal fields were covered with a deposit of coal as thick as we may justly suppose they once were, and as the remaining still are, the available area would be increased to about 2,000 square miles, or 1,280,000 acres; equal to a coal deposit of 92,840,960,000 tons.

Contemplating the number and extent of the coal beds, a total thickness of 107 feet, distributed in fifteen workable beds, interstratified with a full mile in thickness of rock and shale, we are lost in wonder at the luxuriant growth of tropical plants required to produce this vast amount of compressed fuel, and the mighty processes of nature by which it was placed in its present position. The ingenuity of scientists is taxed to account for this wonderful accumulation of fuel, once vegetable, now mineral; once waving in fresh green beauty on the surface of the earth, now buried under hundreds of feet of solid rock; once growing in a level deposit of mud so plastic that the lightest leaflet dropping on its surface, left its impress; now the mud hardened into slate, and the rank vegetation changed to hard and glittering coal, rising and falling in geologic hills and valleys, surpassing in number, depth, extent, sharpness of flexure and acuteness of angle, anything visible in the light of upper day.

Some slight idea of the growth of these ancient forests may be gained from the computation that to form only one of these large beds of coal required a deposit of vegetable matter perhaps one hundred feet in thickness. What shall we say then to the amount of vegetation stored away in the mammoth bed which extends through all three of the anthracite coal fields, covering an area of 300 square miles, with an average thickness of twenty feet, and containing, it is estimated, 6,000,000,000 tons of coal.

Not less wonderful and interesting than the coal deposits is the grand floor of conglomerate which underlies them; a vast sheet of rock, infinitely old, composed of fragments of other rocks infinitely older, bound together by an almost imperceptible cement which holds them so firmly that gunpowder will scarcely separate them. Whence came this great sea of pebbles, water rounded and water-borne to their present resting place? We find them now as the current has dropped them—masses of silex as large as ten-pound cannon balls, and almost as round, so shapely have they been worn by the action of some ancient current. These were deposited first, and then, in regular order, trending to the southwest, came sizes graduated down to those of a pea and grains of sand.

This more than marble floor bears few saurian foot prints; scarcely an impress of bird or beast or fish, or sign of animal life. Nothing but a bed of almost pure silica; a solid foundation on which to build up the mass of rock and the fossil fuel that we call anthracite, older than the hills and predestined for the use of coming man.

The pebble-laden flood ceased, and was followed by placid waters and gentle currents, bringing fine mud and silt to cover the rocky bed. Then the waters drained away, or the land rose, until fit for vegetable life, it was covered with the mighty flora of the car-

joyous times in camp; the meat is disposed of first and then the younger people engage in various games while the older ones gather around some aged crone, who excitedly recounts the hunts of her girlhood days, plentifully intermixing stray portions of the old sagas and legends with which her memory is replete. Thus they live from day to day, the men hunting and the women stretching the skins, till the season comes around when they must return to the coast. Happy, contented, vagabond race! no thought of the morrow disturbs the tranquility of their minds.

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boniferous period. Again it sank, carrying with it its store of decayed and decaying vegetation, and another flood of pebbles rolled over it.

How many ages were consumed in the process so briefly described, who can tell? Nature's operations are on too vast a scale, and her working time too long to admit of hasty activity in the production of results. It may well be said that all the years since the creation of man would be too short a time to produce a bed of coal.

However long the process just described, it was of frequent repetition during the coal period; and thus we find pebble-beds, slate and coal in often recurring series, as in the following cross-section made at Trevorton, the western terminus of the middle Anthracite coal basin.

But through all the changes of time and scene, the upheavals and depressions, the submergence and emergence of the land, we find a remarkable uniformity in the growth of plants, continuing almost without change throughout; sigillaria, lepidodendra, ferns, etc., following their kind, unvaried through successive series of strata, in each leaving their characteristic impress of stems and foliage on the enduring tables of the rocks. The coal flora is rich in variety and of great beauty, as Professor Lesquereaux's careful research abundantly testifies. Their exact forms show a quiet condition of the waters, at least during the deposit of the slate covering of the coal beds; and the intervening rocks show the same facts. When impressions of the flora are found in the solid coal itself, we have the same evidence; but this is of rare occurrence. The best impressions usually occur in the smooth top slate covering the coal beds.

When we examine the arrangement of the Pennsylvania Anthracite beds we wonder at their complexity. Without evidence of volcanic disruption, not even a protruded trap-dyke, or extensive up or down throw, we often find contortions and disturbances of the strata. The beds are rarely horizontal, but lie at every angle, and sometimes even pass the perpendicular and fold back upon themselves. In places they occupy our mountain summits, nearly 2,000 feet above the level of the sea, and again depressed more than 3,000 feet below it, making a variation of a mile in altitude. Yet the coal, which is the frailest material in all this rocky mass, is not destroyed, but generally in good workable condition—solid, almost crystalized, almost pure carbon, and frequently in beds too thick for economical working.

Faults in the Anthracite beds usually have a north-west and southeast direction, and show the beds compressed, and again correspondingly enlarged, but no sudden dislocations or breaking off of the strata. Soft coal, or dirt faults, are of common occurrence in the red ash or softer coals in the western end of the Anthracite fields.

The colored ash of burned coal is due, doubtless, to the presence of iron; but why this coloring matter is confined to the upper series of coals in the eastern portion of the range, and to the lower beds in the western district; and why there is a gradation in the middle district, from white ash in the lower to grey in the middle and red in the upper beds, are problems yet to be solved.

How shall we account for the great disturbance of the strata from their original horizontal position? Was it caused by volcanic force—of which there are no indications—or by contraction of the earth's crust? And if the latter, why is it confined to the Anthracite region, and not extended to the Bituminous also? And how shall we explain the isolation of the smaller coal fields, like those of Rhode Island, Richmond, Va., or Deep River, in North Carolina; or the disproportion in quantity between the limited area of Anthracite and the widespread fields of Bituminous? Why do we find an abundance of shells and remains of animal life in the latter, and rarely any in the former? A few saurian footprints recently found at the Ellangowan Colliery, in Schuylkill County, and a few shells found in the Glendower Pit, in the Wyoming Valley, are signal exceptions to an almost universal rule. After an exploration, covering the period from 1835 to 1850, Prof. H. D. Rogers and his corps of assistants failed to find any other specimens. Neither has Prof. Lesley in his new Geological Survey of Pennsylvania, or the writer in an experience of thirty years' residence and active service, underground and in surface explorations, been any more fortunate.

Nor in all this area do we find a single workable bed of iron or limestone, and scarcely a covering of fertile soil. The coal once exhausted, nothing is left but the worthless shell, desolate and deserted.

The Anthracite region, mainly confined to one-sixth the area of the four mountainous counties of Luzerne, Schuylkill, Carbon and Northumberland, in Pennsylvania, is crowded with an industrious population which increased fifty-one per cent in ten years; that is, from 229,700 in 1860 to 344,771 in 1870; whilst the four adjacent agricultural counties of similar area increased in the same time from 319,542 to 339,942, only six per cent. It is located on the parallel of 40° 30', one hundred miles from any seashore, no part of it less than 500 feet above tide—near the headwaters of the large rivers that drain it—the Susquehanna, Schuylkill, Lehigh and Delaware. The noisy trains crossing the valleys and climbing the mountains all verge, day and night, to these hives of industry, where multitudinous steam engines are hoisting and pumping, and breakers crushing. Thousands of miles of railroad thread the surface and dive into the interior, to roll out the black diamond flood in millions of tons of fuel to warm and employ the nation.

In a second paper, I propose to offer some important statistics and information regarding the harvesting of coal.

As a supplement to articles in the last November and January numbers of the *American Journal of Science*, John M. Stockwell details his investigations into the general theory of the moon's motion as affected by the sun's attraction. While taking a rather despondent view of our present knowledge of the factors in lunar calculation, he admits that the general methods of computation are undoubtedly correct.

J. M. STILLMAN, in August *Journal of Science*, describes the appearance of a new resinous substance in a rocky matrix, from San Barnadino, Cal. It is found in detached masses, in vein form, over a distance of three miles. He seeks to explain its existence by ascribing it to exudations from existing conifers, but does not account for its paragenesis.

SCIENCE :

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JOHN MICHELS, Editor.

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Scientific papers and correspondence intended for publication, should be written *legibly* on one side only of the paper. Articles thus received will be returned when found unsuitable for the Journal.

Those engaged in Scientific Research are invited to make this Journal the medium of recording their work, and facilities will be extended to those desirous of publishing original communications possessing merit.

Proceedings of Scientific Societies will be recorded, but the abstracts furnished must be signed by the Secretaries.

Both questions and answers in "Notes and Queries" should be made as brief as possible; an answer appearing to demand an elaborate reply, may be written in the form of an article.

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AMERICAN ASTRONOMICAL WORK.

The progress of science in the United States cannot be better illustrated than by a brief review of the astronomical work now in progress, and the instruments at the command of those making observations in this country.

Taking as our authority the "Report on Observatories," published by the Smithsonian Institution, and the "Annual Record" prepared by Professor Edward S. Holden, of the U. S. Naval Observatory, Washington, we find that in seventeen States Astronomical Observatories are located, varying in degree of importance from the National Observatory at Washington, to the possessor of a two-inch achromatic telescope of its owner's own make. The work done with the latter instrument being most instructive as showing how

much really good scientific work can be done with limited means when directed by intelligence well applied.

The State of New York can boast of twelve observatories, Michigan four, Pennsylvania three, Massachusetts, Connecticut, Ohio, Missouri, Iowa, each two, and Tennessee, California, Mississippi, Minnesota, Indiana, Kansas, Illinois, Maryland have each one observatory. It will thus be seen what an immense territory is covered by American astronomers, ranging from the shores of the Atlantic to the Pacific coast, and from the tropical regions of the Gulf of Mexico to Lake Superior on the North. Many of these observatories are supplied with requisite appliances of the most perfect description, while all, with one exception, have at least a good achromatic astronomical telescope.

For the benefit of those who desire to promote astronomical research, we may state that the single exception we refer to of an observatory without a telescope, is that of the Ohio State Observatory, the director of which is Professor R. W. McFarland, who states that he "was trying to get the authorities to do something," apparently with poor results.

Among the largest equatorials directed nightly to survey the heavenly bodies may be mentioned the great 26-inch instrument, by Messrs. Alvan Clark & Sons, at the Naval Observatory at Washington, under the charge of Professor Asaph Hall (who has already made such important discoveries with it), assisted by Professor Edward S. Holden; the Dearborn Observatory at Chicago possesses an 18½-inch equatorial (Alvan Clark); Harvard University employs a 15-inch equatorial by Mertz; the Allegheny Observatory, Pennsylvania, has a 13-inch instrument (Alvan Clark); the Morrison Observatory, Glasgow, Missouri, uses a 12½-inch instrument (Alvan Clark); Professor Lewis Swift at Rochester, New York, has charge of a 16-inch equatorial (Alvan Clark); the lady Professor of Vassar College, Poughkeepsie, has an excellent equatorial of 12½-inch (Alvan Clark), while lastly, Dr. Henry Draper at Hastings, N. Y., owns a 12-inch instrument, also by Alvan Clark.

This powerful battery of astronomical telescopes of the highest excellence might seem to be sufficient for one nation, but the national spirit of American enterprise appears to be strongly infused into this great branch of scientific research, for new astronomical telescopes of mammoth proportion and exquisite perfection are now in course of construction for United States observatories, which, in the hands of the able astronomers ready to receive them, will doubtless add to their already well-earned fame and the prestige of science in this country.

With these facts before us, we read without surprise the note by Professor O. Stone in our last issue, in which he says of a recently published "Record of the Progress of Astronomy during the year 1879, by Mr. Deyer, of Dublin, one-third of the memoir is devoted to the result of astronomical work done in the United States.

An article on this subject would be incomplete without a reference to the very perfect work of Messrs. Alvan Clark & Son, of Cambridge, Mass., who appear to have distanced both the English and the Continental opticians in the excellence of their objectives, and who have secured to the United States the honor of supplying the objective for the great equatorial about to be manufactured for the Russian Government, to be used in the Pulkowa Observatory by the distinguished astronomer, Otto Von Streuve. We also notice that of the forty observatories recognized by the Smithsonian Institute, seventeen have telescopes made by this firm. In regard to the work now in progress at the Messrs. Clark's establishment, it may be stated without exaggeration that the world awaits with eager expectancy the result of their labors.

We record with pleasure the very perfect harmony with which American astronomers co-operate and work, which has doubtless been a leading point in gaining the successes that have been attained. This is in strong contrast with the constant bickering among members of the Royal Astronomical Society and many English astronomers, some of whom have not thought it humiliating to charge the Astronomer Royal with ignorance, and a stubborn adhesion to error, and to allege that members of the council of the Royal Astronomical Society suppress the papers of their fellow members from personal and unworthy motives.

Of American astronomers, it might seem invidious to make a personal reference to particular men, but the names of Newcomb, Hall, Eastman, Holden, Stone, Burnham, Draper, Swift and Rutherford are familiar in all civilized countries, and respected wherever the science of astronomy is appreciated.

M. MASCART has been making some observations at the College of France, on atmospheric electricity, with a Thomson quadrant electrometer, the deflections of the needle being transmitted to a pencil. The two pairs of quadrants are kept at equal potentials of contrary sign by two poles of a battery which communicate with the ground; the needle is connected with a vessel letting flow a continuous stream of water into the outer air. Generally the potential of the air, always positive, is found much higher, and more uniform by night than by day. From 9 P. M. to 3 A. M., it varies little, falls at daybreak, reaches a minimum about 3 P. M., and rises rapidly to a maximum about 9 P. M. It is commonly thought that there are two maxima, viz. morning and evening, and two minima, one in the daytime, the other at night. M. Mascart believes that insulation has been too much neglected.

A NEW ELECTRIC PILE DEvised BY M. REYNIER.

Translated for "SCIENCE."

M. Emile Reynier, the electrician, and inventor of an electric lamp, which we have more than once had occasion to present to our readers, and which its author has never ceased to improve and perfect, with the view of making its use more satisfactory, more convenient, and more economical, has now arranged a pile, which is at the same time powerful and economical. This apparatus is composed of a glass vessel in the form of an oblong square, in which is immersed a sheet of copper bent upon itself, as shown in Fig. 1. Upon the bottom of this copper hook rests a cup of parchment, into which the zinc plate is placed, as shown in Fig. 2.

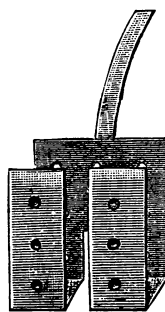


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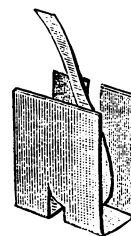


FIG. 2.

FIG. 1.—THE COPPER PLATE OF THE PILE OF REYNIER.

FIG. 2.—THE ZINC PLATE OF THE PILE OF REYNIER.

This vessel or porous diaphragm has this peculiarity, that it is made up of a conical sheet of parchment, and that corresponding with the rectangular or octagonal form, just as may be chosen, it is folded upon itself (Figs. 3 and 4) as indicated by the tracings of the diagrams (Figs. 5 and 6). The strongly marked lines in the figures represent the folds of the angles, the figures indicating the faces, whilst the lighter lines represent the intermediate folds which insure the stability of the system.



FIG. 3.



FIG. 4.

FIG. 3.—PARCHMENT DIAPHRAGM OF THE HEXAGONAL FORM.

FIG. 4.—PARCHMENT DIAPHRAGM OF THE RECTANGULAR FORM.

When the different parts are thus mounted, forming the group known as an element (Fig. 7), a solution of caustic soda is turned into the porous cup containing the zinc; into the outer vessel, a concentrated solution of the sulphate of copper. The two electrodes, zinc and copper, being placed in relation by the conductors, a constant chemical decomposition begins. This pile, which M. Reynier qualifies as

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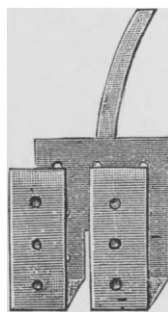


FIG. 1.

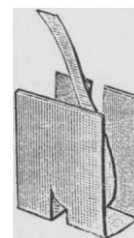


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hydro-electric, is superior, as a working electro-motor, to the Daniell pile, of sulphate of copper and sulphate of zinc; of equal size, and is about twice as powerful as the ordinary Bunsen pile of the laboratories, and is only surpassed by the special form of the Bunsen pile, devised by Ruhmkorff.

"The zinc is not amalgamated," says M. Reynier in his note to the Academy of Sciences, "nevertheless, it is not attacked when the circuit is open by the alkaline solution which bathes it; consequently, the quantity of zinc consumed must give precisely the measure of the amount of elec-

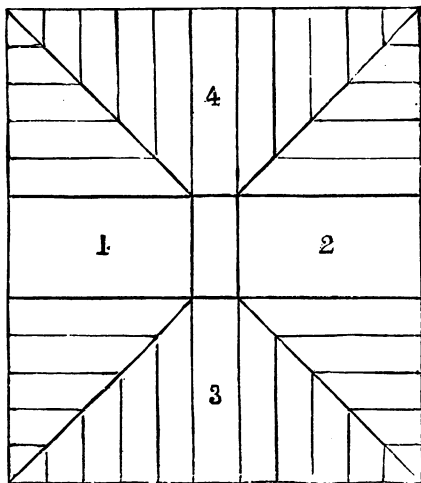


FIG. 5.

FIG. 5.—PARCHMENT SHEET TRACED FOR THE RECTANGULAR FORM.

tricity disengaged. The new pile" he adds, "does not send off volatile products; hence the materials employed are not subject to waste. It is therefore possible to regulate the products of the chemical changes, and they may even be restored to their original state. It is necessary, to do this, to cause a quantity of electricity a little greater than that which has been disengaged by the pile, to traverse the exhausted liquids, dissolving the copper displaced, and removing the zinc dissolved. This renewal of the materials of the pile restores its electro-motor qualities. When elec-

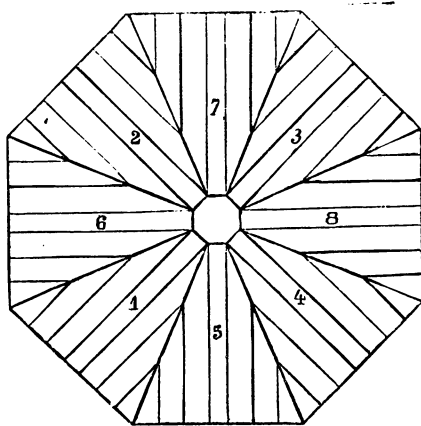


FIG. 6.

FIG. 6.—PARCHMENT SHEET TRACED FOR THE HEXAGONAL FORM.

tricity is thus produced by the aid of a powerful machine, it will be found to be stored up in the solutions and metals, in a state of energy, and can thus be readily set free or transported. The indirect transportation of electricity by this apparatus would be in most cases, of more practical use and more convenient than the direct transmission by cables.

"In fact, when fresh solutions only are used, the new couple has the advantage of a noticeable economy of material and manipulation over the ordinary nitric acid couple. Regarding the practical realization of the process of regeneration which must make my pile economically applicable to small electric motors and to private illumination, there are still certain obstacles of a practical nature which appear to me to be by no means insurmountable."

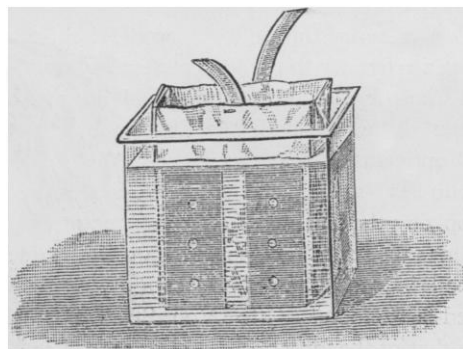


FIG. 7.

FIG. 7.—REYNIER'S PILE COMPLETE.

M. Reynier's pile has been submitted to repeated trials, notably by the *Société Française de Physique*, with fifty couples or elements; the inventor operated successively a voltmeter, the electric motors of Gramme and of Deprez, a large Ruhmkorff coil, and an electric lamp with Serrin's regulator. A platinum wire 65 centimetres in length and half a millimetre in diameter, was maintained at a white heat for more than an hour, while the galvanometer failed to show the slightest decrease of power in the pile.—*La Science pour Tous*.

M. POINCARÉ presented to the Academy of Sciences, Paris, the results of an investigation of butcher's meat, in which he found cylindrical pointed elements with cuticles crossed by lines which seem outlines of cells, and which appear granulated. He thinks they may be phases or metamorphoses of tænioides, causing tænia in some eaters of raw meat.

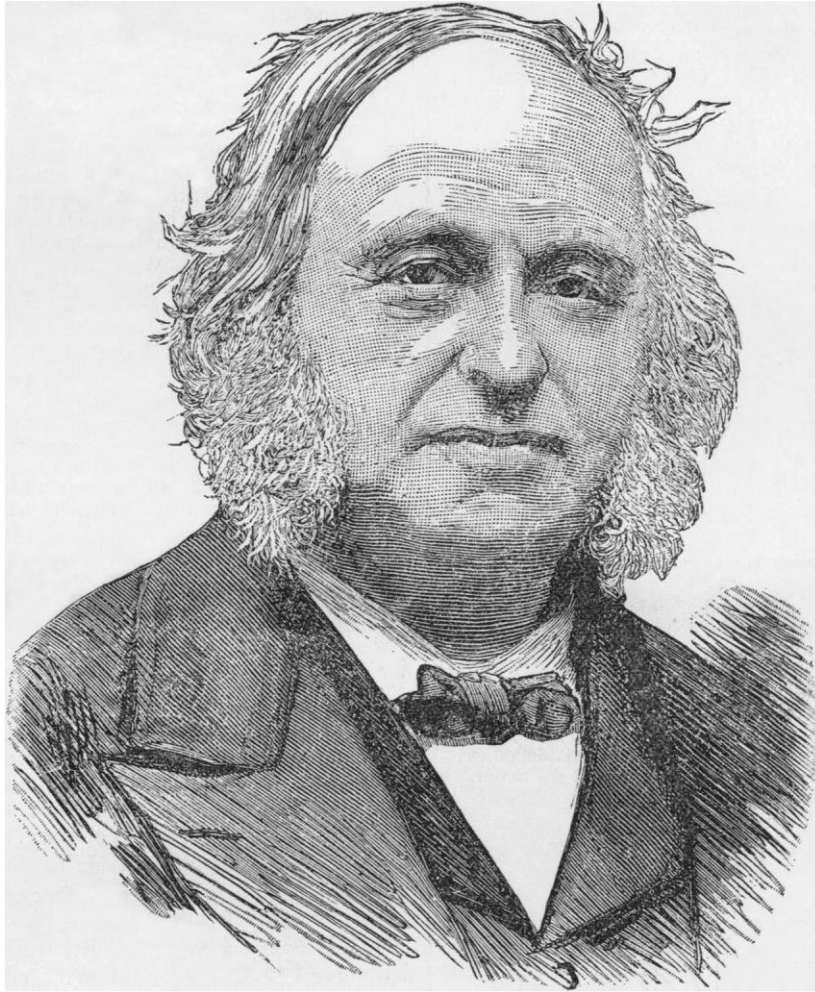
DR. J. LAWRENCE SMITH has determined and named the new mineral Peckhamite found on the outer surfaces of the remarkable meteorite whose fragments were sown across the borders of Dickenson and Emmet Counties in north-western Iowa. By an average of two of Dr. Smith's analyses it contains 49.55 per cent. silica, 16.44 per cent. ferrous oxide and 32.76 per cent. magnesia. By calculation of the oxygen ratio the formula $\text{SiO}_2\text{RO} + \frac{1}{2}(\text{SiO}_2\text{R}_2\text{O})$ would represent its composition, suggesting two atoms of Enstatite or Bronzite plus one atom of Olivine. This is one of the most interesting meteorites known. Over 5,000 fragments of it weighing about 30 kilograms, have been collected from over a distance of eight miles long by one-half mile wide. Although the lumps have been lying on the wet prairie for nearly a year, they are not in the least rusted, and bear a great resemblance to nuggets of platinum. Dr. Smith surmises the rapid passage of the meteorite through our atmosphere caused its disintegration, pulverizing the stony part completely and leaving the nodules of neckiliferous iron untouched. This hypothesis is novel and plausible.

DR. PAUL BROCA.

Since the lamented death of Claude Bernard no name has been added to the necrology of France, which has caused more universal regret than that of Dr. Broca. Each, devoted to a special department of science, became illustrious from patient and untiring research

which led to definite results. Claude Bernard's investigations into the glycogenic function of the liver stand a monument to his genius and indefatigable industry. Although Dr. Broca became famous as a surgeon and anatomist it is the work he did in the department of anthropology that has made his reputation world-wide.

He was born in 1824, at Sainte Foy la Grande



DR. PAUL BROCA.

(Gironde), became vice-president of the Academy of Medicine, officer of the Legion of Honor, and a member of several learned societies. During the greater portion of his life he was Professor of Surgical Pathology to the Faculté de Médecine, and surgeon to the hospitals. His numerous contributions to science relate chiefly to Anthropology, and undoubtedly France owes to Broca, more than any other, the advanced position she occupies as a promoter of this science.

In 1861, he made the remarkable discovery that the seat of articulate language is situated near the third frontal convolution on the left side of the brain. From this time he devoted himself to the study of the cerebral convolutions and ganglia and thus opened up a field for scientific research hitherto almost unknown. His works on "cerebral localizations" and "comparative anatomy of the cerebral convolutions" were pioneers in this

department of science, and are to-day standard authorities on this subject. To Broca is due the founding of the Anthropological Society of Paris, and later of the now celebrated Ecole d'Anthropologie, with its magnificent museum, libraries and laboratories, and a complete course of lectures by a faculty of professors comprising such names as Mortillet, Bertillon, and Topinard. Broca himself had charge of the department of comparative anatomy of the primates.

His sudden death is supposed to have been due to a cerebral hæmorrhage, induced perhaps, by excess of labor and fatigue. Thus in the vigor of life and in the midst of his work, has died a scholar, philosopher and statesman, whose illustrious example will continue to enlighten the path of those who follow his imperishable footprints.

THE WINGED PHYLLOXERA.

J. S. Hyde, of Santa Rosa, California, a few days since, while examining some grape-vine roots infested with the *phylloxera* remarked to some friends present that there was little danger of a rapid spread of this pest, as the insect, in its winged form, had not yet appeared. The words had scarcely passed from his lips when one of the gentlemen cried out: "I see one with wings now!" On a more careful examination eight full-winged specimens were found; the next day four other specimens were discovered. Several of these insects were sent to Dr. Hilgard of the State University for examination.

The above announcement by Dr. Hyde is very interesting, and not the less so from the fact that the insects he sent to Prof. Hilgard, although truly a winged form, were sterile, and not capable of spreading the destruction which our vine-growers fear. In order to

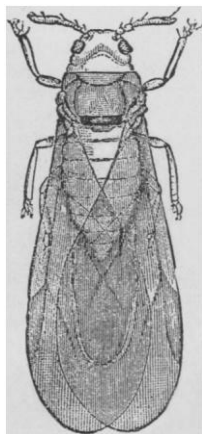


FIG. 1.

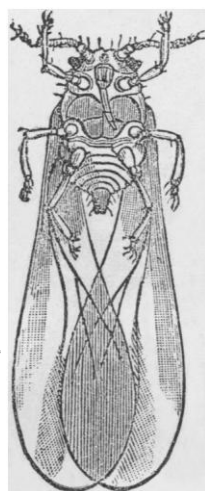


FIG. 2.

show the difference between the fertile and infertile winged-forms, we have reproduced engravings from Prof. Riley's drawings of the *phylloxera* which show clearly the distinction between the two. Fig. 1 is the fertile winged female, which thus far has not been observed in this State, unless some of the insects retained by Dr. Hyde are of this form. Fig. 2 shows the outline of each of the five specimens received by Prof. Hilgard. It will be observed that in the fertile winged female the abdomen is prolonged and that the body is about half as long as the whole insect, wings included, and is of a tapering, rounded form. In the sterile, the body is rarely one-third the length of the whole insect, and the abdomen is abruptly contracted, as shown in the engraving.

Concerning the finding of the sterile winged form by Dr. Hyde, Prof. Hilgard spoke at the meeting of the Horticultural Society as follows: "After all the matter still rests pretty much as we conjectured two years ago. I then stated that either the winged *phylloxera* was not here at all, or in very small numbers. There are five or six varieties of the insect non-winged, which live on the roots, and which produce a winged form towards autumn, which, like the wingless form, is simply a female which

lays eggs without any connection on the part of the male. The winged female is simply an egg-layer, like the others. She lays a few eggs only. Some of these eggs produce males and others females. It seems to be necessary that there should be a kind of renovation of the race in that way. The winged insect is dangerous, of course, because it is capable of flying to some extent. In Europe the winged form has been known to traverse a distance of 30 or 40 miles at one jump, leaving districts between unaffected. In Sonoma the progress of the pest has been slow, and it has been thought that the winged insect was absent. The winged forms produce only two varieties—one fertile, the other infertile. I understand that in other countries the proportion of infertile insects is small. Of the eight specimens sent me by Dr. Hyde, I find that five are of the infertile kind. I infer, therefore, from the evidence thus far produced, that the spread of the pest will still be comparatively slow, depending upon the kinds that crawl instead of those that fly."

The announcement of Dr. Hyde, which was made to the *Rural Press*, will doubtless induce a still wider search for the winged insect. We shall be pleased to receive any specimens which may come to the eyes of our readers to determine their exact standing.

INSTANTANEOUS PHOTOGRAPHY IN A BALLOON.

PAUL DEMARETS.

Since the memorable day when the bold Pilâtre de Rozier and the Marquis d'Arlandes left the earth for the first time, up to the present, all aerial travelers have been struck with the clearness with which the celestial landscapes have opened up to their view. The idea of employing photography to fix these admirable contours is contemporaneous, so to speak, with the invention of Niepce and Daguerre.

To M. Nadar belongs the credit of making the first attempts, and to M. Dagon the merit of remarkable execution in bringing the ascensions under control. But in spite of these successes, thanks to the generous aerial hospitality of M. Henry Giffard, one would think that the fixation, at a distance, of celestial landscapes upon a sensitized plate in a balloon, was a mere chimera. In fact the rapidity of the motion of the aerostatic globe, and the rotation about its axis, would seem insurmountable obstacles.

Attention has been recently directed to the rapidity of impression which may be attained, and which I believe I have increased by the aid of certain re-agents; but one difficulty still to be surmounted was the want of some means by which the operculum could be closed with such rapidity that the operation would take only a fraction of a second.

The readers of *L'Electricité* know how M. Stein, the able experimentalist of Frankfurt, sought for a solution of this problem. It has also described the ingenious apparatus which M. Janssen has made use of in his observatory at Mendon, by which he has secured great rapidity of action on burning a thread of silk which held the mechanism in position. But it was impossible to use this apparatus in an aerostat, although admirably adapted to observation from a fixed position. I should, therefore, have been unable to employ this method if the idea had not occurred to me of using electricity by the aid of the mechanism I am about to describe.

I take a ring, in the centre of which my objective is fixed, normally and solidly, and for the sake of illustration, we shall suppose it to be horizontal. A spring, attached to an arc, situated at the centre and parallel with the objective, presses a horizontal plate, parallel with the ring of the base. This plate bears a shoulder which rests upon a vertical piece of iron. This has a vertical

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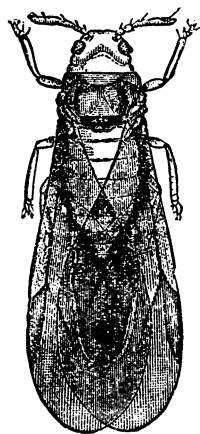


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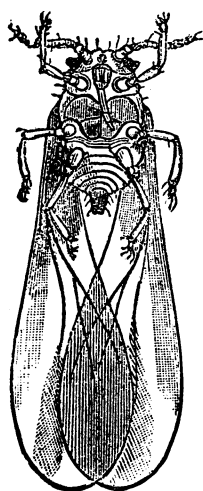


FIG. 2.

show the difference between the fertile and infertile winged-forms, we have reproduced engravings from Prof. Riley's drawings of the *phylloxera* which show clearly the distinction between the two. Fig. 1 is the fertile winged female, which thus far has not been observed in this State, unless some of the insects retained by Dr. Hyde are of this form. Fig. 2 shows the outline of each of the five specimens received by Prof. Hilgard. It will be observed that in the fertile winged female the abdomen is prolonged and that the body is about half as long as the whole insect, wings included, and is of a tapering, rounded form. In the sterile, the body is rarely one-third the length of the whole insect, and the abdomen is abruptly contracted, as shown in the engraving.

Concerning the finding of the sterile winged form by Dr. Hyde, Prof. Hilgard spoke at the meeting of the Horticultural Society as follows: "After all the matter still rests pretty much as we conjectured two years ago. I then stated that either the winged *phylloxera* was not here at all, or in very small numbers. There are five or six varieties of the insect non-winged, which live on the roots, and which produce a winged form towards autumn, which, like the wingless form, is simply a female which

lays eggs without any connection on the part of the male. The winged female is simply an egg-layer, like the others. She lays a few eggs only. Some of these eggs produce males and others females. It seems to be necessary that there should be a kind of renovation of the race in that way. The winged insect is dangerous, of course, because it is capable of flying to some extent. In Europe the winged form has been known to traverse a distance of 30 or 40 miles at one jump, leaving districts between unaffected. In Sonoma the progress of the pest has been slow, and it has been thought that the winged insect was absent. The winged forms produce only two varieties—one fertile, the other infertile. I understand that in other countries the proportion of infertile insects is small. Of the eight specimens sent me by Dr. Hyde, I find that five are of the infertile kind. I infer, therefore, from the evidence thus far produced, that the spread of the pest will still be comparatively slow, depending upon the kinds that crawl instead of those that fly."

The announcement of Dr. Hyde, which was made to the *Rural Press*, will doubtless induce a still wider search for the winged insect. We shall be pleased to receive any specimens which may come to the eyes of our readers to determine their exact standing.

INSTANTANEOUS PHOTOGRAPHY IN A BALLOON.

PAUL DEMARETS.

Since the memorable day when the bold Pilâtre de Rozier and the Marquis d'Arlandes left the earth for the first time, up to the present, all aerial travelers have been struck with the clearness with which the celestial landscapes have opened up to their view. The idea of employing photography to fix these admirable contours is contemporaneous, so to speak, with the invention of Niepce and Daguerre.

To M. Nadar belongs the credit of making the first attempts, and to M. Dagon the merit of remarkable execution in bringing the ascensions under control. But in spite of these successes, thanks to the generous aerial hospitality of M. Henry Giffard, one would think that the fixation, at a distance, of celestial landscapes upon a sensitized plate in a balloon, was a mere chimera. In fact the rapidity of the motion of the aerostatic globe, and the rotation about its axis, would seem insurmountable obstacles.

Attention has been recently directed to the rapidity of impression which may be attained, and which I believe I have increased by the aid of certain re-agents; but one difficulty still to be surmounted was the want of some means by which the operculum could be closed with such rapidity that the operation would take only a fraction of a second.

The readers of *L'Electricité* know how M. Stein, the able experimentalist of Frankfort, sought for a solution of this problem. It has also described the ingenious apparatus which M. Janssen has made use of in his observatory at Mendon, by which he has secured great rapidity of action on burning a thread of silk which held the mechanism in position. But it was impossible to use this apparatus in an aerostat, although admirably adapted to observation from a fixed position. I should, therefore, have been unable to employ this method if the idea had not occurred to me of using electricity by the aid of the mechanism I am about to describe.

I take a ring, in the centre of which my objective is fixed, normally and solidly, and for the sake of illustration, we shall suppose it to be horizontal. A spring, attached to an arc, situated at the centre and parallel with the objective, presses a horizontal plate, parallel with the ring of the base. This plate bears a shoulder which rests upon a vertical piece of iron. This has a vertical

motion within a solenoid. As soon as the current passes it is obliterated by virtue of the attraction, of which Mr. Page and Mr. Bourbouze have made such intelligent use. The plate, meeting no resistance, turns just as it reaches the shoulder. I can give to the spring any tension whatever, so that the time the movable plate takes to make a half or quarter revolution can be regulated at will. The impression is taken during the passage of the aperture in the movable plate across the aperture in the fixed plate. It is easily understood how it may be possible to shorten the time of passage, either by substituting a simple slit or by increasing the tension of the spring.

In order to estimate the time precisely during which an impression is taken, certain experiments are necessary which I have not yet been able to carry out, and which are of the most delicate kind. I may say that this time appears to me not to exceed eight or ten hundredths of a second. Should it be found that it is only one half of a hundredth, I shall not be at all surprised; for the clearness with which I have obtained my images proves the exposure to be so short, that, when the aerostat is moving six to ten metres in a second, it does not traverse any perceptible space while the aperture is uncovered.

A photograph taken at Rouen, in the vertical position, and with by no means favorable circumstances (it was after six o'clock in the evening), shows all the objects contained in a surface of three hundred metres square. I should think that I was then at a distance of 1100 metres from the earth.

Thanks to the excellent instrument of M. Trouvé the weight of my apparatus is only 700 grammes, and is so manageable that after having made a part of the connection I have obtained a marvellous view of the Seine, showing all of its numerous windings, even to Quilliboëuf, and perhaps still farther.—*L'Electricité*.

MR. BRAMWELL ON THE PERKINS SYSTEM.

In view of the report about to be made by order of the United States Government, on what is called the Perkins system, employed by the "*Anthracite*," the little screw steam yacht which recently crossed the Atlantic with so much success, the following report made by Mr. Bramwell at the request of the Perkins Engine Company before the departure of the yacht, may be of interest to engineers and those interested in steam navigation. The engines of the vessel, like her boilers, are of peculiar type, and are the invention of Mr. Loftus Perkins—of the direct acting inverted pattern with surface condensation. They consist of two cylinders, the after of which is bored in two diameters. The smaller diameter bore forms the high pressure cylinder, and receives steam from the boiler during the first half of the down stroke; the larger diameter is the medium or intermediate cylinder, and is supplied at the upstroke with the steam used in the smaller bore during the preceding downstroke. The exhaust from the large bore passes into a chamber, and thence to the low pressure or forward cylinder, giving a total expansion of thirty-two times. The distribution of steam in the after cylinder is effected by three lifting double-beat valves of somewhat peculiar construction, but the low pressure or forward cylinder is fitted with an ordinary slide-valve, having an expansion valve on its back. The condenser is fitted with galvanised wrought-iron tubes, rising vertically from a tube plate, and having closed tops. Within these tubes are smaller ones, through which the seawater enters and passes down the annular spaces to the inlet of the circulating pump. The exhaust steam comes into contact with the exterior of the galvanised tubes, and, when condensed, is drawn off and returned to the hot well surrounding the upper part of condenser. The space between the high-pressure piston and the upper side of the intermediate piston is in connection with

the chamber from which the low-pressure chamber is supplied with steam. The cylinders and covers are heated by steam, which circulates through wrought-iron pipes cast into the thickness of the metal, and they are also clothed to prevent loss of heat. The boiler is formed of rows of horizontal wrought tubes, 3 inches in external diameter, connected at frequent intervals by vertical thimbles, the whole series being contained in a wrought-iron double casing, having the space filled in with vegetable black. The boiler is supplied with fresh distilled water, a still being fitted in connection with the condenser to keep up the supply. The actual dimensions of the cylinders are high pressure $7\frac{3}{4}$ inches, diameter, intermediate 15 13-16 inches, and the low pressure 22 13-16 inches, the latter alone being double-acting. The stroke is 15 inches. These are the chief features of the engines. The trial carried out by Mr. Bramwell appears to have been confined to taking diagrams, and weighing the coal consumed, which was done with minute accuracy, the weight of the sacks being deducted from the gross total. But Mr. Bramwell says that before comparisons can be properly instituted between the economy of the engines of the *Anthracite* and those of different construction, the latter should be tried with the same rigor as characterised the trial of the former. We venture to think, however, that engineers will scarcely regard the trial as altogether what could be wished, for there are several questions of much interest, to which no answer can be found in the report. However, 128 diagrams were taken, and the net result shows that the consumption per horse-power was 1.7 lb. per hour,—a very good result for engines so small, but not quite so low as might have been expected. The precautions taken by Mr. Bramwell to obtain a correct estimate were complete so far as they went, and his report is minute in its details. The throttle-valve, stop-valve, and other parts were sealed in the positions to which they were placed, and the coals having been weighed into sacks, the bunkers were closed and sealed. The trial lasted for 12 h. 3 min., but after the 15th cwt. of coal had been used the engines were allowed to run until they stopped through the burning down of the fire. For 10 hours, however, the mean revolutions were 130.7 per minute, the average indicated horse-power during nearly nine hours being 80.9. The loss of water during the whole 12 hours was $23\frac{1}{2}$ gallons. The mean pressures of the various diagrams were ascertained by dividing the areas (obtained with the planimeter) by the length of the diagrams, a method which Mr. Bramwell thinks more accurate than measuring the height. The engines worked with remarkable smoothness and regularity, and with the exception of tightening up two glands about an hour after the start, there was not a spanner or hammer, or any tool used about the engines, nor was a single handle shifted during the 12 hours the vessel was under way. The link motion was in full gear during the whole run, with stop-valve full open, and throttle set so as to cause the engines to run about 130 revolutions per minute. About one gallon of lard oil was used, the cylinder and slide dispensing with lubricant in the Perkins system; grease being inadmissible where it is liable to come into contact with the steam in these engines. It is reported that the *Anthracite*, in her voyage across the Atlantic, used only 20 tons of coal, and 436 gallons of fresh water, and it would be of considerable interest, as Mr. Bramwell suggests, to have a thorough trial of a compound engine of about the same power, viz., from 70 to 90 horse-power. In connection with the trial upon which Mr. Bramwell reports there is a point which we should like to see elucidated. The boiler-pressure is supposed to have been somewhere about 360 lb. on the square inch, but the maximum pressure on the first piston is only about 200 lb., and the average in the first cylinder about 120 lb., a rather serious discrepancy, though this ratio of loss is not unknown.—*Eng. Mech.*

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PHYSICAL NOTES.

COPPER-PLATING ON ZINC.—The use of Cyanide baths for plating on zinc has the double disadvantage of being poisonous and expensive. Hess, it is stated, has overcome the objections by rendering the cyanide bath unnecessary. This he accomplishes by the use of an organic salt of copper, for instance, a tartrate. Dissolve 126 grammes sulphate of copper (blue vitriol) in 2 liters of water; also 227 grammes tartrate of potash and 286 grammes crystallized carbonate of soda in two liters of water. On mixing the two solutions a light bluish-green precipitate of tartrate of copper is formed. It is thrown on a linen filter, and afterwards dissolved in half a liter of caustic soda solution of 16° B., when it is ready for use. The coating obtained from this solution is very pliable, smooth, and coherent, with a fine surface, and acquires any desired thickness if left long enough in the bath. Other metals can also be employed for plating in the form of tartrates. Instead of tartrates, phosphates, oxalates, citrates, acetates and borates of metals can be used, so that it seems possible to entirely dispense with the use of cyanide baths.

MM. LETHUILLER and Pinel, of Rouen, have devised an electrical indicator, by means of which the water-level in steam boilers may be ascertained at any distance. The arrangement employed for this purpose consists of an indicating tablet, which may be placed in any part of the establishment, however remote from the boiler-house, in the office of the engineer or the superintendent, or within reach of the boiler inspector. This tablet is connected with the electric indicator, which is fixed at the top of a vertical tube above the boiler, by two electric conducting wires. At the lower part of the scale of the indicator are placed two pieces of copper, upon each of which is fastened a small plate. These platinum wires are superposed at a distance of 0.08 in. When the index, which is attached to a vertical rod connected with the float in the boiler, descends, it rests on the upper plate of platinum, depresses it, and puts it in contact with the lower plate. An electric current is thereby established from a battery connected with the apparatus, causing a bell on the indicator to ring, while at the same time the sign "low water" appears on the tablet. Similar pieces of copper and platinum are fixed at the upper part of the scale, and when the index reaches this limit, in consequence of the rising of the float, the bell rings as before, and the indication "high water" is shown on the tablet. In order to remove the warning word from the tablet, a button is pressed, which returns the indicating parts to their normal position.

It is but a short time ago we were pleased to see an original article, written by a Japanese, on the combustion of carbon, at low temperatures, and again we are reminded of the "new departure" in an article on the determination of the acceleration due to the force of gravity, at Tokio, Japan (*Amer. Jour. of Sci.* for Aug.), in which the writer, Mr. T. C. Mendenhall, acknowledges the assistance of Messrs. Tenaka and Tenakadate, of the Department of Physics, of the Imperial University of Japan. The method employed was the usual one, which involves the use of a good chronograph and a break-circuit clock, together with an arrangement by means of which the experimental pendulum can be made to record its own beats upon the chronograph at any time. As the resistance offered to the pendulum, although small, is perceptible, it will interfere with its motion if the pendulum is obliged to operate the break circuit at each beat. Mr. Mendenhall obviates the difficulty by making the pendulum break the circuit but twice, once at the beginning of the period and once at the end. By this process the experiment need not be protracted, and yet a great degree of accuracy may be obtained. As the average duration of the experiment is only twenty minutes, differences of temperature may be neglected, and all the conditions may be maintained constant during the whole time of the swing.

PROF. JOSEPH LE CONTE, in an article read before the National Academy of Science, takes issue with Helmholtz on some important points in the latter's conception of the Law of Listing. This law has important bearing on the phenomena of binocular vision. Its application, however, from the conclusive experiments of Prof. Le Conte, must be limited to other motions of the eye than those taking place in strong convergence. In thus differing from the high authority of the great German, Prof. Le Conte in a philosophical spirit worthy of more general imitation, deprecates the too common method of trying to verify the results of others, rather than to determine the law for one's self.

As a considerable difference exists between the results obtained by the formulæ of Le Verrier and Stockwell in calculating the longitude of the perihelion and the eccentricity of the earth's orbit, Mr. R. W. McFarland in August *Journal of Science*, gives a comparative table, in periods of 10,000, extending over 4,500,000 years. It is accompanied by a chart (with ordinates at intervals of 50,000) dividing the time into two periods, viz., for 3,250,000 years before, and 1,260,000 years after A. D., 1850. An inspection of the table shows that the motion of the perihelion is exceedingly irregular and occasionally retrograde.

JAS. CROLL, F. R. S., makes mention of an article written by himself in *Phil. Mag.* xxxiii., 1867, pp. 213-216, which may not have been before presented to the American public, in which he accounts for the remarkable fact, first observed we believe, by Mr. Glaisher, that the difference of reading between a black-bulb thermometer exposed to the direct rays of the sun, and one shaded, *diminishes* as we ascend into the atmosphere. Mr. Croll deduces from this, that radiation into stellar space is the medium for the preservation of snow in elevated places, and the protective action of aqueous vapor the cause of its melting in places where there is a greater snow-fall, a remark in perfect harmony with Prof. Tyndall's important discovery regarding the influence of aqueous vapor on radiant heat.

PROFESSOR HENRY DRAPER read a paper of great interest before the Royal Astronomical Society in May, which now appears for the first time in this country.—(*American Journal of Science*.) He gives facts which seem to point to the conclusion that it is not improbable that Jupiter is still hot enough to give out light, though perhaps only in a periodic or eruptive manner. He applied spectroscopy to the problem and submitted to the Astronomical Society the photograph upon which he based his ingenious speculations. We are glad to see that Prof. Draper has been assisted by his wife in these observations. Humboldt long ago suggested as an advantage to science that the finer senses of women be used in astronomical research.

A NEW and abundant locality for the mineral Danburite has been discovered by Mr. C. D. Nims, the mineral collector, in St. Lawrence County, N. Y., which is said by Messrs. Brush and Dana (*August American Journal of Science*), to be of considerable extent and importance. The mineral occurs massive, micro-crystalline and also in druses of magnificent appearance, where, in one instance, a crystal was found 4 inches long and 2½ inches macro-diagonal width. The crystals were originally embedded in a younger calcite which has been much eroded. The paragenesis (in a matrix of granitic rock) seems to be, from their description, quartz, danburite, pyroxene and tourmaline and last a pink calcite. It is also accompanied by pyrite. Messrs. Brush and Dana elaborate their description and enrich it with many angular measurements. The homœomorphism of topaz and danburite are conclusively demonstrated, and an opportunity has been seized to supplement and revise the observation made at the time Smith and Brush worked on the original mineral from Danbury.

O. A. M.